Form 2-102 (Rev. July 1963)

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF COMMERCIAL FISHERIES

OPERATING PROGRAM

Field Station or Office of Origin	Region or Area	
Woods Hole, Massachusetts	Region 3, Gloucester, Massachusetts	
Subactivity (Symbol and Title)	**Program Title:**	**Program No.**
431 Coastal and Offshore Research	Oceanography	431.8

PROGRAM COMPONENTS OF COST	Previous Program	This Action	Current Program
10. Personal Services (Detail on reverse side)			
21. Travel and Transportation of Persons			
22. Transportation of Things			
23. Rent, Communications & Utility Services			
24. Printing and Reproduction			
25. Other Services - Contract		28,000.00	28,000.00
26. Supplies and Materials			
31. Equipment			
Other			
Sub Total Program Direct Cost		28,000.00	28,000.00
Program Indirect Cost			
TOTAL OPERATING PROGRAM		28,000.00	28,000.00

BREAKDOWN BY PROGRAM FEATURE

NUMBER	PROJECT	Previous Program	This Action	Current Program
	Woods Hole Oceanographic Institution Contract		28,000.00	28,000.00
	Sub Total Program Direct Cost		28,000.00	28,000.00
	Program Indirect Cost			
	TOTAL OPERATING PROGRAM		28,000.00	28,000.00

ESTIMATE OF EXPENDITURES BY QUARTERS - F.Y. 19

Object Class	First	Second	Third	Fourth
Personal Services				
All Other Expenditures				
Total Operating Program				

Prepared By:
Name Title Date

Approved By:
Herbert W. Graham Laboratory Director 7/19/63
Date

30579

Region #3

Briefing Statement
(In thousands of dollars)

Program Without Increase

Coastal and Offshore Research
(Subactivity)

No.	Title		1965	1964	1963	1962
		$	28.0	28.0	28.0	28.0
431	Oceanography	PP	0	0	0	0

Program:

Work plan: Contract with Woods Hole Oceanographic Institution.

Objective: To study the meteorological and hydrographic conditions that might relate to the changing abundance of fishes in the Northwest Atlantic.

Accomplishments FY 1963: Observation posts at lightships were maintained and the annual reports of temperature and salinity published. Drift bottles and sea bed drifters were released throughout the area Cape Hatteras to Nova Scotia. Analysis of surface currents made.

Base of operations: Woods Hole, Massachusetts.

Briefing Statement
(In thousands of dollars)

Region #3 — Program with Increase — Coastal and Offshore Research (Subactivity)

No.	Title		1965	Increase	1964	1963	1962
		$	28.6	28.6	- -	- -	- -
131	Oceanography	P.Y.	1	1	- -	- -	- -

Increase:

Need: Until this year S-K funds have supported a contract with the Woods Hole Oceanographic Institution to maintain coastal oceanographic observation posts and study ocean currents. Additional funds are required to make offshore observations with the ALBATROSS IV, and analyze the results on a sustained basis.

Work plan: Surveys with the ALBATROSS IV and the placement of recording devices.

Objective: To provide the environmental information required to understand the fluctuations in abundance and availability of groundfish in the New England area.

Additional positions: One GS-13 oceanographer.

Program:

Objective: To understand the relationship between oceanographic conditions and the groundfishes of the Northwest Atlantic.

Accomplishments FY 1963: Under S-K funds observations posts at lightships were maintained and the annual report of temperature conditions and salinities were published. Surface current observations were made by means of drift bottles.

Base of operations: Woods Hole, Massachusetts.

Review of Whiting Research

The first full year of the whiting project was in 1955. Immediately a study was started to determine the different stocks of whiting present. Morphometric studies indicated that the southern New England, New York, and New Jersey whiting could be separated from the fish in the Gulf of Maine, Conover et. al. (1961).

Investigations were conducted to develop a successful tagging method. Fritz (1959) reported that whiting were very difficult to obtain in good condition for tagging. Even with considerable effort to minimize the effect of capture by trawls, only one-third of the fish were judged to be in a condition suitable for tagging. Nevertheless, a modified plastic tube tag did show returns of 5%, 8% and 9% in three experiments.

Observations were reported on the food habits (Jensen and Fritz, 1960). Fish and shrimp supplied the bulk of the diet. A larger study, still unpublished by Dr. Ralph V. Dexter of Kent State University, corroborated the findings of this Laboratory. An abstract of this study (Dexter, 1962) is published.

Mesh selection studies reported by Clark (in press) and Clark and Fritz (in press), as well as studies completed since then, show a very dull selection curve for whiting. Whiting were shown to escape in great numbers through the forward part of the net.

The history of the fishery was reported by Fritz (1960). Since 1930 the annual landings have increased more than ten-fold. In addition the method of fishing has changed from pound nets and float traps to otter trawls.

A general review of our knowledge of the whiting was published by Fritz (1962). A simplified life history was presented.

It should be noted that the Russians are fishing whiting. Domanevsky and Nozdrin 1963 have reported on general observations made on this species.

Whiting in the New York bight were investigated by Shaefer (1960). General growth analyses and food habit studies were reported.

Bibliography

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In press. Escape of fish through various parts of the trawl. Lisbon Symposium, ICNAF Special Publication.

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Conover, John J., Raymond L. Fritz, and Manuel Vieira.
1961. A morphometric study of the silver hake. U.S. Fish and Wildlife Service, Special Scientific Report 368: 13p.

Dexter, Ralph W.
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------ 1962. Silver hake. Fish. Leaf. (538): 7p.

Jensen, Albert C. and Raymond L. Fritz.
1960. Observations on the stomach contents of the silver hake. Trans. Am. Fish. Soc. 89(2): 239-240.

Schaefer, Richard H.
1960. Growth and feeding habits of the whiting or silver hake in the New York Bight. N. Y. Fish and Game Journ. 7(2): 85-98.

Form No. 2-127
6-60

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF COMMERCIAL FISHERIES Contract No. 14-17-0007-175

V-4

This Contract, entered into this 4th day of October, 1963 by the United States of America, hereinafter called the Government, represented by the Contracting Officer executing this contract, and

Woods Hole Oceanographic Institution, Woods Hole, Massachusetts,

hereinafter called the Contractor, witnesseth that the parties hereto do agree as follows:

ARTICLE I. STATEMENT OF WORK. The Contractor shall furnish the necessary personnel, facilities, materials for performance of the following work.

The Contractor shall continue a program of investigation and observations (1) to detect changes in oceanic circulation (2) analysis of climatic and weather records to determine cause of such changes (3) investigation of circulatory system along North Atlantic coast to facilitate interpretation of observations, and (4) consultation and collaboration with U. S. Fish and Wildlife Service Laboratory, Woods Hole, Massachusetts, and as particularly set forth in the Contractor's proposal dated July 30, 1963, with the exception that on page 2 of the proposal, item 8, "Estimated costs: per year" this contract shall be limited to a total cost of $28,000.00. This adjustment is per a joint agreement between your Institution and Dr. H. W. Graham of this Bureau.

ARTICLE 2. COST. For performance of this contract the Government shall pay to the Contractor the sum of $28,000.00 payable as follows:

Quarterly on December 31, 1963, March 31, 1964, June 30, 1964, and September 30, 1963, in equal amounts of $7,000.00

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ARTICLE 3. PERIOD OF CONTRACT. Work shall be commenced October 1, 1963, and shall be completed not later than September 30, 1964.

ARTICLE 4. GENERAL PROVISIONS. The attached "General Provisions", Form 2-127a, are incorporated herein and made a part of this contract.

ARTICLE 5. ALTERATIONS. The following changes were made in this contract before it was signed by the parties hereto:

Work performed beginning October 1, 1963, pursuant to informal instructions from Regional Director, Bureau of Commercial Fisheries, Gloucester, Massachusetts, is hereby confirmed and shall be deemed to have been performed under this contract.

IN WITNESS WHEREOF, the parties hereto have executed this contract as of the day and year first above written.

Woods Hole Oceanographic Institution
(Contractor)

By: Roderick H. Ketchum

Acting Director 11/4/63
(Title)

THE UNITED STATES OF AMERICA

By: [signature]

Chief, Branch of Property Management
(Title)

Department of the Interior
Fish and Wildlife Service

PROPOSED PROJECT UNDER SALTONSTALL-KENNEDY ACT
(P.L. 466, 83rd Congress, 2nd Session)

For consideration by the Industry Advisory Committee

1. Major field: Oceanography

2. Title of Project: Investigation of climatic and oceanographic factors influencing the environment of fish.

3. Proposed by: Woods Hole Oceanographic Institution
Paul M. Fye, Director

4. General description: The abundance and distribution of the great populations of fish change from time to time. The objective of this research proposal is to find out to what extent these changes are related to shifts in the ocean circulation, and what climatic influences may bring about such shifts. The fishing industry will benefit if it is known what factors other than fishing have influenced or are likely to influence the fisheries.

5. Method of procedure:

   1. Continuation of program of observations to detect changes in oceanic circulation.
   2. Analysis of climatic and weather records to determine cause of such changes.
   3. Investigation of circulatory system along North Atlantic coast to facilitate interpretation of observations. (Supported by other agencies).
   4. Consultation and collaboration with U. S. Fish and Wildlife Service Laboratory, Woods Hole, Massachusetts.

6. Work to be performed by: Woods Hole Oceanographic Institution.
   Personnel available - Oceanographer with 26 years' experience, meteorologist with 20 years' experience.
   Facilities - Oceangraphic equipment aboard 15 Lightships.

7. Estimated duration of the project: This contract is for 1 year.
   Continuation to be anticipated since objectives are long range.

8. Estimated costs: per year

Salaries	$14,150
Indirect Costs (55% provisional)	7,782
Retirement (8 5/8% provisional)	1,220
Materials and Supplies	13,419
Travel (See Text)	2,000
Fee at 5%	1,929
	$40,500

Dean F. Bumpus
D. F. Bumpus, Principal Investigator

H. MacKillop
H. M. MacKillop, Comptroller

Bostwick H. Ketchum
Bostwick H. Ketchum, Associate Director

Amplification of Project for

Investigation of oceanographic and climatic influences on the environment of fish

Proposed by Woods Hole Oceanographic Institution

The Problem

One of the hazards of the fishing industry is the uncertainty in the numbers of fish to be found in any place at any time on any given fishing ground. Over longer periods the area frequented by a given species may contract or expand unaccountably.

The short-term fluctuations in the fisheries are known to result from "good" or "bad" success in each year's reproduction, but why large numbers of young fish survive in some years and not in others is not understood. Even more mysterious are the causes of the expansion of fish populations into new territory, or their disappearance from regions where they were formerly abundant.

Far too often the fishermen themselves are made a scapegoat, when it is charged that the changes are due to overfishing. Certainly this is not the cause of the good or bad years of reproduction, or of the cataclysmic destruction of whole populations, such as have occurred from time to time.

It is reasonable to believe that many of the fluctuations in the distribution of fish and in the success of their natural breeding arise from actual changes in the quality of their environment; to shifts in the temperature of the water, or its salinity, or in the currents which control the supply of food. This is the hypotheses on which the present proposal is based.

Along the Atlantic seaboard fishing is conducted chiefly within the limits of the continental shelf. In these waters the conditions influencing the environment of fish depend on three factors: (1) the general circulation of the Atlantic Ocean, and particularly the behavior of the Gulf Stream; (2) the discharge of rivers along the shore, which establishes and maintains the coastal circulation; and (3) the local climate which influences the temperature of the water.

A great quantity of information is being collected which bears on these influences. Oceanographers are now studying actively the oceanic circulation and have investigated from time to time various aspects of the coastal circulation. Systematic records of water temperatures are made at the tide stations maintained by the Geological Survey. Climatic data are now available in the records of the Weather Bureau. The flow of the coastal rivers are recorded by the Geological Survey. The fishery statistics supply an abundant record of the availability in time and place of the important fish populations.

The previous contract between this Institution and the U.S. Fish and Wildlife Service (Contract 14-19-008-2377, 14-17-008-62, 14-17-007-9 and 14-17-007-104) commenced a sustained effort to relate the existing information to the behavior of

fish.

and

systematic observations were made of the variability of the environment in the coastal waters where fish live, and of the variations in the circulation of that environment.

The Woods Hole Oceanographic Institution is qualified to secure and continue such observations and to correlate the information obtained, to the end that the relations of climate and oceanic circulation to the varying distribution and abundance of fish may be better understood.

Procedure

1. A program of observations will be maintained consisting of:

   a. The establishment, maintenance and servicing of systematic observations of temperature and salinity on twelve available lightships along the Atlantic coast. The object will be to secure data from as far seaward as possible.

2. A program of coordination of data will be maintained consisting of

   a. The collection and analysis of all available data from the tide stations, lightships, weather ships, and research vessels bearing on the actual state of coastal waters, and on the circulation of the adjacent deep ocean, including the Gulf Stream.

   b. The collection and analysis of all available meteorological and hydrological data bearing on the climate of the North Atlantic coast and on the flow of rivers into the sea.

   c. The analysis of the above information in relation to the accepted views of the coastal circulation, and the correlation of the findings with information obtained from fishery statistics.

3. An essential part of the proposal is that fundamental studies of the circulatory system of the continental coast be made as an aid in interpreting the fluctuations in the state of the coastal waters. The observations to be obtained will be of limited value if they cannot be interpreted in terms of well-recognized patterns of circulation. The character of the circulation in the Gulf of Maine and along the middle Atlantic coast has been studied by Bigelow and others but much more information is required, particularly in areas of acute interest to the fisheries. South of Cape Hatteras little was known of the coastal circulation until recently when Mr. Bumpus, who would serve as project leader under this proposal, undertook its study. Much valuable data on the hydrography of this area are available, to which attention should be given to perfect our knowledge of its waters. (This part of the project will be

supported in part by funds from other agencies.)

4. Personnel engaged in the program will be available to the Fish and Wildlife Service at all times for consultation on oceanographic and climatological problems. The Institution is located adjacent to the Woods Hole Laboratory of the Service and enjoys relations with the personnel of that laboratory which assure the cooperation and collaboration necessary for the success of the present proposal. Close relations have also been maintained with the Biological Laboratories at Boothbay Harbor, Maine; Sandy Hook, New Jersey and Beaufort, North Carolina.

Results:

The monitoring of the distribution of temperature and salinity at lightships along the Atlantic seaboard has resulted in a series of reports which describe the annual cycle of temperature and salinity and seek to explain the causes of changes which are observed.

Bumpus, D.F. 1957: Surface water temperatures along the Atlantic and Gulf Coasts of the United States. U.S.F.W.S. Spec. Sci. Rept. - Fisheries No. 214, 153 pp.

Bumpus, D.F. 1957: Oceanographic observations, 1956, east coast of the United States. U.S.F.W.S. Spec. Sci. Rept. - Fisheries No. 233, 132 pp.

Chase, J. 1959: Wind induced changes in the water column along the east coast of the United States. J. Geophys. Res. 64(8):1013-1022.

Day, C.G. 1959: Oceanographic observations, 1957, east coast of the United States. U.S.F.W.S. Spec. Sci. Rept. - Fisheries No. 282, 123 pp.

Day, C.G. 1959: Oceanographic observations, 1958, east coast of the United States. U.S.F.W.S. Spec. Sci. Rept. - Fisheries No. 318, 119 pp.

Day, C.G. 1960: Oceanographic observations, 1959, east coast of the United States. U.S.F.W.S. Spec. Sci. Rept. - Fisheries No. 359, 114 pp.

Day, C.G. 1963: Oceanographic observations, 1960, east coast of the United States. U.S.F.W.S. Spec. Sci. Rept. - Fisheries No. 406, 59 pp.

Chase, J.: Oceanographic observations, 1961, east coast of the United States. U.S.F.W.S. Spec. Sci. Rept. - Fisheries in ed.

The study of the circulation on the continental shelf has resulted in the following papers:

Bumpus, D.F., J. Chase, C.G. Day, D.H. Frantz, Jr., D.D. Ketchum and R.G.Walden 1957: A new technique for studying non-tidal drift with results of experiments off Gay Head, Mass., and in the Bay of Fundy. Jour. Fish. Res. Bd. Canada 14(6):931-944.

Bumpus, D.F. and C.G. Day, 1957: Drift bottle records for the Gulf of Maine and Georges Bank, 1931-1956. U.S.F.W.S. Spec. Sci. Rept. - Fisheries No. 242, 61 pp.

Day, C.G., 1958: Surface circulation in the Gulf of Maine as deduced from drift bottles. Fishery Bull. 58(141):443-472.

Bumpus, D.F., 1960: Sources of water contributed to the Bay of Fundy by surface circulation. J. Fish. Res. Bd. Canada, 17(2):181-197.

Bumpus, D.F., 1961: Drift bottle records for the Gulf of Maine, Georges Bank and Bay of Fundy, 1956-58. U.S.F.W.S. Spec. Sci. Rept. - Fisheries No. 378.

We intend, in the foreseeable future, to publish a folio on the surface circulation on the continental shelf, Cabot Straits to Florida, in the American Geographical Society's Serial Atlas of the Marine Environment.

Personnel and Facilities

The Woods Hole Oceanographic Institution is a non-profit corporation with over thirty years' experience in investigation of the western Atlantic Ocean. It operates five seagoing research vessels and employs a scientific staff of some sixty oceanographers, meteorologists, chemists, and biologists. It maintains simple technical services to support the scientific staff.

The proposed investigation will be placed under the leadership of Mr. Dean F. Bumpus, an oceanographer with twenty-six years' experience in the study of the hydrography and biology of coastal waters, assisted by Mr. Joseph Chase, a meteorologist with 20 years' experience, 13 of them directly associated with problems in physical oceanography.

Duration of Project

A continuation contract for one year is proposed. It is evident from the nature of the proposed work that its objectives are long range, and will have little value if not continued for a longer period.

The salary schedule provides for 20% of the principal investigator's salary, 50% of his associate's salary, full salary for two clerk-technicians and about 1000 hours of minimum wage service.

Indirect Costs are estimated to cover cost of occupany, maintenance, and administration. The actual rate is computed every six months based on actual costs as determined by Navy Auditors. All indirect costs are allocated between contracts with the government, with other contractors and the Institution's own work on the same basis.

The sum of $2000 budgeted for travel includes travel of the principal investigator to the ICNAF Environmental Symposium to be held in Rome in late January 1964, where he will be the convenor of one of the panels.

Signed Dean F. Bumpus

July 30, 1963

D. F. Bumpus, Prin. Investig.

Investigations of Climate and Oceanographic Factors

Influencing the Environment of Fish.

Accomplishments to date are these:

1. Continuing series of temperature and salinity measurements at a dozen or more lightship and other locations from Maine to Florida since the end of 1955. These measurements have revealed the effect of drought and subsequent high precipitation on the hydrography of the Gulf of Maine, the annual mid-summer intrusion of cold saline water along the bottom toward the coast off New Jersey, Delaware and Virginia, and are beginning to be useful in examining the effect of climatic trends.

2. Never before have so many drift bottles been released and recovered as there has in the joint U. S. and Canadian surface circulation study. During the 11 year period ending in 1962, 160,423 drift bottles were released; over 10.1% were recovered. This data is being used to prepare a series of surface circulation charts to be published in the American Geographical Society's Folio Atlas series.

3. A simple device, for use in much the same manner as the drift bottle, has been developed for gaining information on the non-tidal drift along the bottom. Our understanding of this circulation is beginning.

4. A telemetering or transponding drift buoy system has been devised for observing non-tidal currents at mid-depths. Experiments have been conducted south of New England, in the Bay of Fundy, on Georges Bank, and between Cape Cod and Cape Hatteras.

5. Through contracts with AEC, experiments employing Richardson Current Meters have been conducted south of New England. Some experiments off Cape Canaveral have been highly successful. If we can maintain our patience during this trying developmental period, we shall have a real break-through. The need for direct current measurements has been obvious for many years. Its achievement is in sight!

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Bumpus, D. F., J. Chase, C. G. Day, D. H. Frantz, Jr., D. D. Ketchum and R. G. Walden, A new technique for studying non-tidal drift with results of experiments off Gay Head, Mass. and in the Bay of Fundy. Jour. Fish. Res. Bd., Canada 14(6), 1957.

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Bibliography of Publications Concerned with the Oceanography of the Gulf of Maine

John B. Colton, Jr.

In this bibliography the term "oceanography" has been used in its broadest sense and includes basic studies of biology, chemistry, physics, geology, paleontology, ecology, and fisheries hydrography. Published reports through June, 1962, of oceanographic surveys for the period of record are included.

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1934 A note on the phytoplankton in the summer of 1933. Biol. Bull., 67: 76-82.

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1933 Cons. int. Explor. Mer. Copenhagen 1934.

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1957b. Oceanographic observations, 1956, east coast of the United States. U. S. Fish and Wildlife Service, Special Sci. Rept., Fisheries No. 233: 132 p.

1960 Sources of water contributed to the Bay of Fundy by surface circulation. J. Fish. Res. Bd. Canada, 17: 181-197.

1961 Drift bottle records for the Gulf of Maine, Georges Bank and Bay of Fundy, 1956-58. U. S. Fish and Wildlife Service, Special Sci. Rept., Fisheries No. 378: 127 p.

BUMPUS, D. F., J. CHASE, C. G. DAY, D. H. FRANTZ, D. D. KETCHUM and R. G. WALDEN

1957 A new technique for studying non-tidal drift with results off Gay Head, Mass., and in the Bay of Fundy. J. Fish. Res. Bd. Canada, 14: 931-944.

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1934a. Factors effecting the vertical distribution of copepods. Ecol. Mon., 4: 530-540.

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1946 Dynamics of production in a marine area. Ecol. Mon., 16: 322-335.

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